

Ethnic differences in the relationship between ambulatory blood pressure levels and body composition in young employed women. G.D. JAMES, CVC, Cornell Medical College, NY, NY 10021.

Several studies suggest that there are differences between African-American (AA) and Caucasian (C) women in the pattern of blood pressure measured at work (W), home (H) and sleep (S). The purpose of this study was to assess whether body composition and physical activity contributes to this difference. The subjects of this study were 110 women (27 AA, age=31.0±8.5 yrs, 83 C, age=29±6.7 yrs) who were employed as secretaries or technicians in NYC. Six skinfolds (SK), body frame size, 2 circumferences, weight, BMI and physical activity (P) were associated with systolic (SP) and diastolic (DP) pressure at W, H, and during S in AA and C women separately using a backward stepwise regression approach. AA women had greater subscapular SK than C women (18 vs 14,  $p<.02$ ), waist SK than C women (20 vs 17,  $p<.09$ ) and weighed more than C women (66.4 vs 61.4 Kg,  $p<.04$ ). The regression results show consistent ethnic differences in the predictors of SP and DP during the day. P at W consistently predicted SP at W ( $p<.02$ ), H ( $p<.02$ ) and S ( $p<.0002$ ) in Cs, but had no relationship among AAs. Increased BMI, smaller frame size and suprailliac SK consistently predicted SP in AAs at W ( $p<.001$ , .006, .001), H ( $p<.009$ , .0003, .0007), and S ( $p<.0005$ , .001, .03), but had no relationship among Cs. Weight was inversely related to DP at W and S among Cs ( $p<.05$ ), but was directly related among AAs at W ( $p<.06$ ), H ( $p<.002$ ) and S ( $p<.03$ ). Smaller frame and suprailliac SK were also consistently related to DP at W ( $p<.05$ , .002), H ( $p<.0001$ , .0001), and S ( $p<.01$ , .01) among AAs, but not among Cs. Finally, P at home predicted SP ( $p<.009$ ) and DP ( $p<.002$ ) at home among AAs but not Cs. Interestingly, none of the factors examined predicted DP at home among the C women. These results suggest that among young women, the BP of Cs may vary more by stress associated behavior related to work, whereas among AAs, body composition may be more predictive of daily BP level.

Supported by NIH grants HL47540 and HL37054

How many populations of early North Americans were there? R. L. JANTZ, Anthropology, Univ. of Tennessee, Knoxville, TN 37996 and D. W. CWSLEY, Anthropology, Smithsonian Institution, Washington, DC 20560.

Paleo-American crania have contributed little to the discussion of variability among early and recent populations, in part because they are widely scattered individual specimens. The usual approach is to pool them to form a paleo sample, which masks variability among them.

This paper adapts an existing methodological approach to investigating the question of variability among individual crania. It is a form of canonical discriminant analysis, where the covariance matrix of a reference sample (W), taken to represent the variation in a single population, is compared to the covariance matrix (H) of a sample of early Americans. Eigenvalues obtained from W'H and the Mahalanobis distances were tested by resampling the reference sample.

The method was applied to 11 early American crania as follows:

Specimen	Sex	Location	Date
Spirit Cave	M	Nevada	9415 BP
Wizard's Beach	M	Nevada	9500 BP
Prospect	M	Oregon	>7000 BP
Wet Gravel 1	F	Nebraska	12000 BP
Wet Gravel 2	M	Nebraska	12000 BP
Brown's Valley	M	Minnesota	8900 BP
Pelican Rapids	F	Minnesota	7840 BP
Medicine Crow	M	S. Dakota	5500 BP
Turin	M	Iowa	4720 BP
Lime Creek	M	Nebraska	-
Swanson Lake	M	Nebraska	-

The last two are undated, but circumstantial evidence would place them in the Archaic period, if not earlier. The Wet Gravel dates are geological and require verification.

The 11 crania exhibit highly significant variation, which is consistent with 3-5 distinct populations. Group membership follows geographic and temporal lines to some extent. Medicine Crow and Turin, both middle Archaic from the Plains are strongly differentiated from all other crania. Pelican Rapids, Brown's Valley, Lime Creek and the Wet Gravel female form a Paleo/early archaic group from Minnesota-Nebraska. Spirit Cave, Wizard's Beach, and Prospect form a Northwest group, which is loosely linked to two Nebraska crania.

The results show that it is critical to recognize the marked heterogeneity among early American crania. This along with the finding that most early American crania are different from recent American Indians means that the history of American populations is much more complex than has generally been supposed.

#### **Traumatic Stress, Cardiovascular Disease, and the World War II Incarceration of Japanese Americans: A First Look.** G. M. JENSEN, University of Colorado, Denver, CO 80217-3364.

During WWII, the U.S. government forcibly relocated over 110,000 Japanese Americans in ten remote prison camps without due process of any kind. This incarceration disrupted the lives of Nisei (second generation Japanese Americans), challenged their self-image as fully vested American citizens, and caused traumatic stress in many individuals. This study asked whether formerly interned Japanese Americans have an increased risk of cardiovascular disease and/or premature death (<60 yrs. age) when compared to non-interned Japanese-Americans.

**Methods:** Two levels of data were used. Comprehensive health information was obtained from surveys and interviews of 37 Nisei former internees and 23 Nisei who were not interned. Participants provided information on themselves and their extended families (n=422 kin). In this fashion, health information was obtained for a total of 482. National mortality data were used to evaluate causes of death among California Nisei-age individuals (proxy for former internees; born 1905-1935) and compared with Hawaiian Nisei of similar age (proxy for non-interned status).

**Results:** Cardiovascular disease was two-fold greater in the former internees than in their non-interned counterparts (OR=2.1, CI 1-4.0, n = 482). Logistic and multiple regression analyses of national mortality records indicated that California Nisei-age individuals were 1.1

(CI = 1.02-1.13,  $n = 17,907$ ) times more likely to die from cardiovascular disease, 1.3 (CI 1.2-1.4,  $n = 24,086$ ) times more likely to die prematurely, and died 1.6 years earlier than Hawaiians ( $p = .0001$ ,  $n = 24,086$ ), controlling for metropolitan residence, marital status, and sex.

While national and kin data did not include specific cardiovascular risk factors (e.g., obesity, smoking), these findings support that the stress of arbitrary internment and forced relocation of Japanese Americans during WWII has had long-term health consequences.

Supported in part by a CU Dean's Small Grant.

Exudate feeding and interspecific variability in postcanine size among Callitrichidae. D. JOHNSON. Biological Anthropology and Anatomy, Duke University

Marmosets and tamarins (family Callitrichidae) have an unusual dental morphology among primates (simplified molar morphology, lack of third molars) that has frequently been interpreted as the result of phyletic dwarfing. Rapid progenetic dwarfing can result in an animal having large postcanine teeth relative to body size, which some have proposed is evidenced in callitrichids. Recent studies, however, fail to demonstrate the presence of unusually large postcanines in callitrichids (Plavcan & Gomez, 1990, 1993a, 1993b). Most of the callitrichid species studied actually have smaller postcanines than expected, giving negative residual values when plotted against a regression line.

The current research includes a greater variety of species of callitrichids than earlier studies and finds substantial interspecific variability in postcanine size when scaled against body weight. It is proposed that this variability has a functional and adaptive explanation associated with exudate feeding. Particularly within the genus *Callithrix*, species which show high frequencies of exudate feeding tend to have smaller molars than non-exudate feeders. Exudate feeding has a potentially confounding role in identification of phyletic dwarfing in callitrichid lineages, as relatively large postcanines (as expected in progenetic dwarfs) might be disadvantageous for animals which depend largely on exudates.

Natori and Shigehara (1992) compared the anterior dentition of several species of marmosets (*Callithrix*) and concluded that there were differences in lower incisor morphology according to the degree to which each species exploited exudates as a dietary component. However, their quantification of incisor size was based upon comparisons with areas of the first and second molars. If molar area does not scale predictably with body size among callitrichids, then postcanine size should not be used as a proxy for body size. A possible reinterpretation of their results is suggested by the current study, that molar size varies with exudate feeding.

Taxon-specific reactions to trapping among Ethiopian baboons. C.J. JOLLY, New York University, New York, NY 10003; J.E. PHILLIPS-CONROY, Washington University School of Medicine, St Louis, MO 63110.

Discussions of the ultimate causes of altruistic behavior often invoke critical situations ("How much fitness should I risk to save my cousin from a leopard?") Such events are rarely observed in nature, but may be artificially simulated. While live-trapping hamadryas and anubis baboons, we have noted consistent age-, sex- and taxon-associated patterns of behavior. During baiting, adult male hamadryas baboons tolerate females and young more consistently than anubis males do. When trapped animals are tranquilized and carried off, onlooker baboons often threaten the trapper. Anubis, especially older males, respond most vigorously when an infant is trapped, less for females and juveniles, and minimally for adult males. Among hamadryas, all captured animals are vigorously defended by the group. These reactions are consistent with different levels of intra-group genetic relatedness observed in the two taxa, which themselves presumably result from contrasting patterns of philopatry and migration. These observations fit an explanatory paradigm in which individuals maximize their own inclusive fitness, but are not easily explained by invoking species- or group-advantage.

Supported by: The National Science Foundation, The Harry Frank Guggenheim Foundation, Earthwatch, and New York University.

General health among an early prehistoric population on the Gulf Coast of Mexico. T.L. JOLLY, Department of Anthropology, University of Illinois, Urbana, IL 61801, and A.L. GRAUER, Department of Sociology and Anthropology, Loyola University Chicago, IL 60626.

The Late Formative period on the Gulf Coast of Southern Veracruz, Mexico, dated 400 BC to 200 AD, is noted as being a time of sedentary agriculturalism. While archaeological data suggest that the population subsisted on diets of maize and beans and provide evidence of early writing, little is known about mortuary practices, demographic patterns and the health and disease of these people. This paper serves as one of the first reported skeletal analysis of human material from this period and location. The goal is to

explore whether paleodemographic and paleopathological data can supplement the archaeological record.

Skeletal remains were disinterred during the 1995 and 1996 seasons at La Joya in Comoapan and the 1992 excavation of Bezoapan, located approximately 8 km away. The sample consists of 13 individuals, approximately half of which include both cranial and postcranial remains and the other half of which are teeth alone, in fair to poor condition. In total, the sample yielded 7 adults (2 females, 1 male, 4 of indeterminable sex), 6 subadults, and 3 individuals of undeterminable age. The paleopathological results indicate that 66.7% (4/6) of the population display porotic hyperostosis, 37.5% (3/8) display carious molars, and 42.9% (3/7) exhibit enamel hypoplasia.

Although the limited population sample restricted demographic and paleopathological analyses, this preliminary study suggests that stressors within the population were common. Comparisons between this population and those from other geographic areas are made in order to determine a pattern of similarities and differences in the general health of prehistoric peoples. This project is supported by NSF Grant No. SBR-9350256.

Craniometric variation and selection in an *Alouatta palliata* population. A. L. JONES, Dept. of Anthropology, U.C. Davis, CA 95616; D. DEGUSTA, Dept. of Integrative Biology, U.C. Berkeley, CA 94720; S. P. TURNER, C. J. CAMPBELL, and K. MILTON, Dept. of Anthropology, U.C. Berkeley, CA 94720.

Craniometric variation was examined in a sample of 185 adult *Alouatta palliata* skulls collected on Barro Colorado Island, Panama to document the sexual dimorphism and cranial variation in a single population of mantled howler monkeys. Most previous investigations of these features in howler monkeys used samples drawn from multiple populations.

The skulls were divided into three age stages by occlusal wear (A to C, least to most wear). Thirty-three linear craniometric measures were taken, as well as endocranial volume (ECV). In males, there was a statistically significant increase in well over half the measures (including ECV) between age stage A and age stage B. In females, a similar increase was noted in about one fourth of the measures (but not ECV), as well as increases from age stage B to C. This expansion impacts the pattern of sexual dimorphism: ECV, for example, differs significantly between males and females overall (56.2 ml versus 52.8 ml,  $p < 0.0001$ ), but the difference at age stage A is not significant (54.5 ml versus 52.9 ml,  $p = 0.1155$ ).

There are several possible causes of the unexpected expansion between adult

age stages: growth, environmental fluctuations affecting cohort(s), a relation between occlusal wear and size, or selection (since the animals were found dead). Analysis of the metrics along with a consideration of howler behavior and ecology indicate that size-based selection may be the most likely explanation.

The evolution of sex-biased mortality: Testing theories with diverse Strepsirrhine social systems.

J. H. JONES. Department of Anthropology, Harvard University. Peabody Museum, 11 Divinity Avenue, Cambridge, MA 02138.

Data on captive primate life histories were gathered to test the hypothesis that the pattern of sex-biased intrinsic mortality hazard changes with respect to social system. Male mortality is expected to be higher than female mortality in polygynous species. Demographic data were collected for five species of strepsirrhine primates at the Duke University Primate Center: *Cheirogaleus medius*, *Eulemur fulvus*, *Lemur catta*, *Microcebus murinus*, and *Varecia variegata*. Individual life spans were calculated from recorded dates of birth and death, and Kaplan-Meier survivorship curves were constructed from these intervals. Using a Cox proportional hazard model, four out of five species sampled yielded significantly different mortality hazard for males and females. The *Cheirogaleids* *M. murinus* and *C. medius* display male-biased mortality patterns consistent with their plesiomorphic social systems. For the polygynous Lemurids, *L. catta* and *E. fulvus*, survivorship functions are nearly indistinguishable by sex, in contrast to the predictions of sexual selection theory. In the monogamous Lemurid, *Varecia variegata*, there is a marked and highly significant female-bias in the mortality hazard, again, in contrast to the predictions of sexual selection theory. An alternative life historical perspective is presented to explain these surprising results.

Origins of modern humans: A direct comparison of Y chromosome, mitochondrial, and autosomal data. L.B. JORDE, M.J. BAMSHAD, W.S. WATKINS, S. SUNG, M.E. MOORE, J.K. LUM, and A.R. ROGERS. University of Utah School of Medicine, Salt Lake City, UT 84112

To explore questions about the origins of modern humans, we have analyzed mitochondrial

control region DNA variation, Y chromosome polymorphisms (YAP, 7 microsatellites, and 3 single-nucleotide polymorphisms), and autosomal polymorphisms (60 microsatellites and 30 restriction site polymorphisms) in a collection of more than 300 Africans, Asians, and Europeans.

A new method of analyzing distributions of microsatellite variation in populations (analogous to mtDNA mismatch distributions) provides evidence that African populations expanded earlier than did Asian and European populations. This is in accord with the results of mtDNA mismatch distribution analysis.

Our previous studies indicated that some microsatellites may mutate so rapidly that the evolutionary signal of these systems is quickly lost. Indeed, the correlation between microsatellite population distances and mtDNA population distances improves when microsatellite loci with high allele-size variances are removed. To examine this issue further, we assessed whether allele-size variance in each microsatellite locus was associated the repeat motif or the presence of interruptions in the repeat series. No clear association was observed in this group of polymorphisms.

We have compared Y chromosome and mtDNA variation in several population groups, including African Pygmy and non-Pygmy populations and East Indian populations. These comparisons reveal marked differences in male and female gene flow patterns. Y chromosome variation is currently being compared with mtDNA and autosomal variation in our collection of worldwide populations.

This research was supported by NSF (DBS-9310105; SBR-9514733) and NIH (RR-00064).

**Sexual dimorphisms and species composition of the Lufeng dental samples.** K.E. JUELL and S.C. JOSEPHSON, Anthropology, University of Utah, Salt Lake City, UT 84112, and J. KELLEY, Oral Biology, College of Dentistry, University of Illinois at Chicago, IL 60612

High dental metric variation in the large hominoid assemblage from Lufeng, China (late Miocene) is interpreted in two ways: It represents a single extremely sexually dimorphic species, *L. lufengensis*; or it represents two morphologically similar species that overlap in size. The arguments center largely on interpretations of coefficients of variation (CVs), particularly the frequency by which sample CVs exceed those of referent samples, with claims that "excessive" values serve to falsify the single-species hypothesis. But the CV method is limited; it cannot isolate the respective contributions of sexual dimorphism and intrasexual standard deviation (SD) to overall sample variation.

Method-of-moments can simultaneously estimate sexual dimorphism and intrasexual SD, and enables 95% confidence intervals (CIs) to be derived for the

dimorphism estimate. We use this method to estimate these values for each of the 16 tooth samples (total  $n=755$ ) comprising the entire maxillary and mandibular dentitions from Lufeng, and for similarly sized dental samples of orangutans (*Pongo p. p.*), the hominoid with the greatest postcanine tooth sexual dimorphisms.

Results indicate similar trends in relative sexual dimorphisms for both dentitions. The Lufeng samples exhibit significantly greater postcanine dimorphisms than *Pongo*, with only slight to no overlap of 95% CIs. But they also show lesser canine, and only slightly greater incisor dimorphisms than *Pongo*, with considerable overlap of 95% CIs. Intrasexual SD estimates for the Lufeng samples exceed *Pongo* ones in only 1 of 16 cases, and are otherwise quite similar. We therefore conclude that only one species is present, *Lufengpithecus lufengensis*, a hominoid that possesses extreme postcanine sexual dimorphism.

Dental metrics kindly provided by Dr. Xu Qinghua.

New hands and feet for an old lemur (*Archaeolemur*).

W.L. JUNGERS, R.E. WUNDERLICH, SUNY at Stony Brook, NY 11794, P. LEMELIN, NEOUCOM, Rootstown, OH 44272, L.R. GODFREY, University of Massachusetts, Amherst, MA 01003, D.A. BURNEY, Fordham University, Bronx, NY 10458, E.L. SIMONS, P.S. CHATRATH, Duke University Primate Center, Durham, NC 27705, and H.F. JAMES, Smithsonian Institution, Washington, D.C. 20560.

Paleontological research in the north of Madagascar over the past decade has yielded abundant subfossil remains of *Archaeolemur* sp. cf. *edwardsi*, including associated craniodental and postcranial elements and nearly complete individuals. We are now able to assemble virtually complete hands and feet of this genus for the first time. Lamberton's (1936) reconstruction of *Archaeolemur majori* exhibited relatively large hands and feet with elongated digits, but these were largely plaster fantasies with little resemblance to fossils from the Ankarana and Anjohikely.

Here we focus on the manual and pedal proportions of *Archaeolemur* in comparison to extant lemurs, selected cercopithecoids and two nonprimate mammals. Metric contrasts include relative hand and foot lengths, relative pollical and hallux lengths; prehensility indices, and distal phalanx shape. *Archaeolemur* displays a unique mixture of relatively short, robust extremities as well as relatively short hands and feet. The pollex is also relatively short and adducted; hallux reduction is extreme. Unlike most extant species examined here except for *Didelphis*, there is little difference between manual and pedal prehensility indices in *Archaeolemur*. The apical tufts of the distal phalanges are very expanded in *Archaeolemur*.

Reduced grasping and prehensile capabilities are suggested by this unusual combination of proportions. Multivariate summaries of these data (clustering & ordination of average taxonomic distances) indicate that *Archaeolemur* is more similar overall to some Old World monkeys (e.g.,

macaques and *Nasalis*) than to any extant lemur; however, our results disclose no special phenetic affinity between *Archaeolemur* and either *Papio* or *Theropithecus*. *Archaeolemur* was no doubt more terrestrial than any extant prosimian, but cursorial adaptations were lacking in this powerfully built quadruped. [Nat. Geo. Soc. Grant 4493-91 and NSF Grants SBR-9630350 and GER-9450175]

Bioarchaeological analysis of patterns of health and disease at the Garbacon Creek site (31Cr86), coastal North Carolina. A.M. KAKALIOURAS, University of North Carolina at Chapel Hill, NC, 27599-3120.

The bioarchaeology of the Late Woodland North Carolina coastal plain is complex, and as yet, imperfectly understood. Much of the previous research in this area has focused on diagnosis and prevalences of endemic treponematoses in individuals and populations (e.g. Bogdan and Weaver), substantiating the theory that endemic syphilis was present in the Western Hemisphere before the contact period (Baker and Armelagos, 1988). However, recently a greater understanding has emerged of the broader adaptations of North Carolina coastal groups during the Late Woodland period (e.g. Monahan, 1995), for which this study is a contribution. The focus of this presentation is the Garbacon Creek site (31Cr86), a Late Woodland ossuary from the coastal plain of North Carolina.

New research places the Garbacon Creek site (n=31) within the context of major adaptive shifts that occurred in the late prehistory of the southeastern United States. Analysis and interpretation of patterns of health and disease observed in this population are presented and compared with those of other skeletal populations from this period in North Carolina and the Georgia Bight.

The hypothesis that the Garbacon Creek site represents a population undergoing a shift from foraging to farming is only conditionally supported by the evidence. However, evidence for nutritional deficiencies and endemic treponemal infection does indicate that community health was compromised either by dietary or nondietary factors, such as population increase, greater levels of sedentism, and poor sanitation. Recommendations for further bioarchaeological research are made in the direction of clarifying lifeway interpretations for this site, and for the North Carolina coast generally.

A modest reduction in dietary fats is associated with increased aggression in stump-tailed macaques (*Macaca arctoides*). JR KAPLAN, V WILLIAMSON, Bowman Gray School of Medicine and Wake Forest University, Winston-Salem, NC, USA

A series of retrospective investigations links the consumption of diets low in fat and cholesterol to

elevated levels of aggression in socially-housed cynomolgus macaques (*Macaca fascicularis*). Among human beings, low serum cholesterol (naturally-occurring or purposefully-reduced) has been associated with increased mortality due to suicide and accidents, and with adverse effects on mood and behavior. Due in part to their public health and evolutionary implications, these wholly unanticipated observations have generated considerable controversy. Accordingly, the current experiment was designed to confirm and extend previous behavioral results by applying a prospective, crossover design that exposed 16 stump-tailed macaques to diets high or low in saturated fat but equivalent in cholesterol. Prior to the experiment, all animals consumed a "chow" diet. Upon initiation of the study, half of the animals consumed first a high fat and then a low fat diet; the remaining monkeys consumed the low fat diet first, followed by the high fat diet. Each diet was fed for four months, during which time animals were assessed routinely for behavior, plasma lipids, and glucose metabolism. Total plasma cholesterol was 15% higher ( $p < 0.001$ ) when animals ate the high fat diet (154 mg/dl) than when they consumed the low fat diet (132 mg/dl), irrespective of feeding order. Despite the relatively modest difference in total cholesterol, 15 of 16 individuals exhibited higher levels of aggression (means: 10.6 vs. 4.5 episodes;  $p = 0.01$ ) while eating the low fat diet. Subsequent analyses demonstrated that this effect was independent of feeding order and was associated with an increase in intense, rather than mild, forms of aggression. The diet had no significant main effects on body weight or fasting glucose concentrations. These are the first data to link prospectively the intake of dietary fat to agonistic behavior in primates and may be relevant to observations in humans relating low plasma cholesterol to increased risk of suicide and accidental death, as well as to alterations in behavior, mood, and speed of mental processing. Supported in part by HL 40962.

Virtual Multimedia Examinations: Integrating Images, Video, and Animations into an Interactive Testing Program. J. KAPPELMAN, C. BRAMBLETT, A. GORDON, K. MCCARDEL, T. RYAN, R. SCOTT, E. SEIFFERT, and G. WEINER, Department of Anthropology, The University of Texas, Austin, TX 78712-1086

Advances in multimedia software and the ability to network together clusters of computers have permitted the development of truly interactive, computer-based multimedia examinations. The content of each exam is drawn from the full range of materials from lecture, the readings, and laboratories, and is presented to the student in the form of multiple choice, matching, True/False, plotting, and interactive questions. The questions are integrated with 2D images, video clips, and 3D animations. Answers require the students to respond with a keyboard entry or "drag and place" mouse-driven operations. The grade is calculated automatically and is reported to the student immediately upon completion of the exam.

We have developed very large question banks that are sorted by content as well as level of difficulty. The program is designed to randomly select from among the various categories of questions so that each student

receives a unique but uniform exam. Using the computer to master exams "on the fly" permits the administration of custom exams that are exactly tailored to each individual student. For example, the program can be designed so that an incorrect response leads that particular student through a series of questions that reteaches the correct concept and then retests. On the other hand, a correct response can lead students through a set of increasingly difficult questions so as to evaluate their full mastery of the topic. If a student does poorly on any given topic on the midterm, that particular student will be questioned again on that exact topic on the final exam.

A separate program permits the student to review his or her responses by using each individual student's record of responses to rerun the exam for them. The review program displays both the student's response and the correct response and can be programmed to explain the justification for the correct response.

It is anticipated that computer-based multimedia examinations will soon become the standard for university-level testing.

---

Supported by a grant from the National Science Foundation and the University of Texas at Austin.

Worldwide distribution of Y chromosome haplotypes: Implications for the origin(s) of Native Americans. T.M. KARAFET, University of Arizona, Tucson, AZ 85721 and Institute of Cytology and Genetics, Novosibirsk, Russia, S.L. ZEGURA and M.F. HAMMER, University of Arizona, Tucson, AZ 85721.

Haplotypes constructed from Y chromosome markers are used to trace the origins of Native Americans. Our sample consists of 1678 males from 47 global populations, including 15 Native American and 16 indigenous North Asian groups. A set of nine di-allelic polymorphisms gives rise to 11 unique Y chromosome haplotypes which are unevenly distributed among the populations. Combining multiallelic variation at two Y-linked microsatellites (*DYS19* and *DXYS156*) with the unique haplotypes results in a total of 75 combination haplotypes. The overall  $\Phi_{ST}$  estimate based on the unique haplotypes with linear molecular distances is 0.499.

Of the seven unique haplotypes found in the New World, two are most probably due to admixture while five represent possible founder haplotypes. Two of these candidate founder haplotypes (1C and 1G) are widespread and account for 91% of the Native American Y chromosomes. A third haplotype (1F) with a primarily Asian and Australasian distribution also appears in both the NaDene (Tanana- 42%, and Navajo- 2%) and Amerinds (Cheyenne- 16%, and Wayu- 8%). A fourth haplotype (1I), previously found only in Asia and North Europe, occurs at a low frequency (2%) in the Navajo. Contrasting distribution patterns of these candidate founder haplotypes in Asia and the New World suggest more than one paternal

migration to the Americas *contra* previous findings.

This work was supported by NSF grant OPP-9423429 and NIGMS grant GM53566 to MFH.

Evolutionary "progress" or adaptation? Regulation of neuronal numbers has profound downstream effects: development as a towrope in evolution. H.J.KARTEN, Dept. of Neurosciences, University of California at San Diego, La Jolla, CA 92093.

We generally believe that alteration in numbers of specific cell types in a single structure may result in profound changes in subsequent projection targets in the brain. Experimental studies of neural pathways have frequently shown that injury to a structure such as the retina results in dramatic reduction in cell numbers in both the primary targets of retinal projections, but also in second and third order targets, such as the striate cortex.

But examples of fluctuations in populations based on adaptation to particular ecological niches are few. Far too often the lack of adequate sampling and anecdotal analyses result in conclusions that suggest a structure or system is novel to a single group of animals. If this happens to be a primate, then we often are told that this reflects the advanced evolutionary status of the animal (i.e. it must be superior, since it is closer to humans!).

This faulty logic has been widely promulgated in analyses of the visual system, and the claim that the pulvinar uniquely expands in primates in relationship to their greater "analytic and cognitive" abilities. Support for this conclusion is based on the small size of the pulvinar in rats and cats, animals commonly postulated to represent the more "primitive" stage of visual system evolution. However, many studies have revealed that the pulvinar is quite prominent in squirrels, tree shrews, pigeons, chicks, lizards and other animals. In fact, the correct variable affiliated with variation in size of the pulvinar appears to be the number of cones in the retina, the density of very small retinal ganglion cells, and most directly, the number of neurons in the stratum griseum centrale of the optic tectum.

Failure to obtain adequate sampling of different species, and to recognize underlying determinants of changes in cell number have often led neurobiologists to erroneous interpretations of the function of structures, and the assumption that some structures must therefore be novel, and reflect the evolutionary appearance of "advanced neural capabilities associated with higher evolutionary status."

The determinants of hominid walking speed. C.E. HILTON, Department of Anthropology, University of New Mexico, Albuquerque, NM 87131.

Walking speed or velocity is an important aspect of hominid locomotion and can be defined as the product

of cadence and stride length. Individuals often maintain their own characteristic "normal" walking speed and increasing or decreasing normal speed is usually accomplished by changing cadence or stride length and/or both. Such changes are known to affect the energetic expenditure of walking.

Changes in walking speed influence the overall travel time necessary to cover any given distance on the landscape. In foraging societies, knowledge of the amount of walking time needed to target a particular resource and the subsequent return time may determine whether a resource is acquired in one day or over the course of several days, if at all. Estimating the travel time associated with resource acquisition is important for understanding the behavioral ecology of hominid foragers and, presumably, our fossil ancestors.

This paper examines the determinants of walking speed in two technologically divergent study groups, Venezuelan savanna Pumé foragers and urban dwellers from Albuquerque, New Mexico. The Pumé ( $n = 35$ ) are mobile unshod habitual walkers who do not depend upon transportation technology. The Albuquerqueans ( $n = 91$ ) are shod sedentary individuals who rely heavily on transportation technology. Gait cycle measurements and anthropometrics were collected in controlled and standardized settings for both samples.

Statistical analyses (ANOVAs) indicate significant differences ( $p < .0001$ ) across the study groups and across the sexes for such variables as stride length and walking speed. Interestingly, stride cadence during normal walking is not significantly different across the four subsamples and, in most individuals, stride cadence equals 1 stride/sec. This finding suggests that a measurement of stride length is in fact a measurement of an individual's walking speed. Thus, estimating contemporary and fossil hominid walking speeds may simply be a matter of determining stride length.

Supported by Sigma Xi, the Pumé Locomotor Research Fund, and the Univ. of New Mexico's Latin American Institute and Graduate Student Assoc.

Twin cultures in biosocial perspective. C.M. HILL and H.L. BALL, Department of Anthropology and UCS, University of Durham, Durham DH1 3HN, UK.

We explore the issue of why cross-culturally, twins and twin births have evoked an extreme range of responses from celebration to fear. We suggest that in the absence of twin infanticide cultural responses to twins serve to enhance the infants' chances of survival or reduce the parental costs of twins, thus ultimately enhancing parental reproductive success.

Twin culture, twin rituals and behaviours associated with twin births attracted significant attention from early African ethnographers. In some societies the birth of twins was a joyful event, while in others twin births were greatly feared. The Banen feared twins because they considered them a source of great misfortune. Conversely the Kedjom of Cameroon admired and revered twins, yet also attributed them special powers, which could be harmful. Both societies treated twins with great respect to ensure their benevolence.

We have argued that where infanticide is an option twins will be killed because, ultimately, they are poor viability infants as compared with singletons (Ball & Hill 1996). For parents who attempt to raise twins they are a potentially expensive reproductive investment because as

well as being high-risk infants, two neonates impose a greater energetic cost to their mother in terms of lactation, carrying and general caretaking than does a singleton.

Using a qualitative analysis of the ethnographic data we explore the hypotheses that societies which have special rituals concerning twins are those with unusually high twinning rates; that societies who cannot support more than one infant per family sanction twin infanticide; and that societies with cultural practises involving offerings or special support for twins are those with sufficient surplus or stability that 2 infants can be raised simultaneously, or that the mother can be released from production (or receive extra help). We also document the type of quantitative data necessary to test an adaptive explanation for twin rituals.

We conclude that twin rituals, whether associated with fear or reverence for twins, exhibit a common feature of providing extra resources for the families of twins. One functional outcome is to enhance the survival chances of these high-risk infants. From a biosocial perspective the attributes imputed to twins are irrelevant providing they result in enhanced support for twins and their families.

The anthropology of antemortem tooth loss. S.W. HILLSON, Institute of Archaeology, University College London, 31-34 Gordon Square, London, WC1H 0PY.

Antemortem tooth loss is evident in many archaeological collections of human remains. Teeth may be lost for a variety of causes. Periodontal disease may cause so much progressive bone loss around the roots that teeth eventually lose adequate support, or the process of continuous eruption to compensate for heavy attrition, which also occurs progressively throughout life, may also cause a reduction in support as bone is remodelled around the roots. Another possibility is that bone is lost around the apex of the root, through an inflammatory reaction that results from infection of the pulp. This occurs clinically as dental caries penetrates the crown, or when teeth are fractured, but many reports on archaeological remains have also suggested that heavy wear may be the cause. Teeth with exposed pulps in living people are frequently painful, and are often extracted, so little is known of the extent to which teeth may be lost when untreated. In archaeological skulls, a tooth with an exposed pulp may be associated with generalised bone loss, but others have bone loss confined to the apex, without the main area of supporting bone at the neck of the tooth being affected. In others, it is difficult to distinguish the effects of periapical inflammation from those of long standing periodontal disease.

Most clinical studies of dental caries in modern populations have concentrated on children, amongst whom it is safe to assume that lost teeth were extracted due to pulp penetration by dental caries. It is also often assumed that periodontal disease is most likely cause of tooth loss in adults but, increasingly, it has been shown that tooth extraction relating to coronal caries remains the dominant reason for tooth loss throughout life in populations where cereal based agriculture is the dominant form of subsistence. In recent hunter-gatherer groups with a large intake of carbohydrate containing plant foods, caries also shows a progressive rise with age, in relation to the sites for carious lesion initiation exposed at the edge of extensive occlusal wear facets and between teeth. This, coupled with the effects of continuous eruption seem to cause most tooth loss. There is relatively little clinical evidence, however, that attrition on its own leads to tooth loss. Amongst the recent

Greenland Inuit, who ate no carbohydrates and had very low caries rates, contemporary reports list no pulp exposure due to attrition.

Treponematoses in the Northern and Central Great Plains: it's nature and distribution. D.C. HODGES and S.J. SCHERMER, Department of Anthropology, Northern Illinois University, DeKalb, IL 60115 and Office of the State Archaeologist, University of Iowa, Iowa City, IA 52242.

The nature and evolution of treponemal diseases has received significant attention over the last decade. Much of this debate has focused on the origins of syphilis and its distribution in the Old and New Worlds prior to the time of Columbus. There is some question whether venereal syphilis was present in the New World prior to 1492. This paper reviews the evidence from reports of treponemal infections in the Northern and Central Great Plains in prehistoric and proto-historic skeletal samples.

In prehistoric and protohistoric samples, the reported cases of treponemal infections most commonly consist of long bones exhibiting periostitis with rugose nodes and 'expansions', subperiosteal remodeling characterized by plaques and striations, superficial cavitations, and the appearance of anterior bowing caused by cortical apposition (Gregg and Gregg 1987; Palkovich 1981; Schermer et al. 1994; Waddell 1994). A Late Archaic burial from Saskatchewan with an aortic aneurysm has been attributed to endemic syphilis (Walker 1983). A single crania with caries sicca lesions from Kansas City dating to the Hopewell period has been reported (Stewart and Quade 1969).

This pattern of long bone infection with little or no cranial involvement is consistent with a diagnosis of endemic treponematoses. A general absence of caries sicca lesions and an absence of Hutchinson's incisors and Moon's molars would argue against the presence of a venereal or congenital treponemal infection in the prehistoric populations of the Northern and Central Great Plains.

#### Animal Intelligence: A Three-ring Circus.

W. HODOS, Department of Psychology, University of Maryland, College Park. MD 20742-4411.

The concept of intelligence is a human concept devised to indicate the intellectual ability (as defined by a standardized test) of an individual relative to the particular population for which the test was standardized. The concept is applicable to non-human animals only to the extent that we can obtain comparable performance measures from them. Interspecies interpretations are difficult because intelligence tests are designed to make comparisons within a population, not between

populations, as may be seen in the generally dismal results of using intelligence tests that were standardized on one ethnic group of humans to evaluate the relative intellectual ability of another group of humans.

Discussions of animal intelligence often treat the term "intelligence" as if it were a widely agreed-upon concept in psychology; in fact, the nature of intelligence is now, and since the earliest days of intelligence testing, has been a hotly debated topic. Among the competing theories is the notion of multiple, independent "intelligences", rather than a single entity, known as "general intelligence" that affects all aspects of intellectual performance.

The types of performance measures used to assess intellectual ability are those that humans value for survival and adaptation in their environments; even though animals may exhibit the capabilities for such behaviors, these behaviors may be of no particular adaptive value to them in their native environments. Conversely, the human-oriented view of intelligence could lead to failures to examine behavioral capacities that are of great value to the animals but of little value to humans.

Theories of the evolution of intelligence based on the behavior of non-human primates, non-primate mammals, and representatives of other vertebrate classes, must take into account these conceptual and practical difficulties if they are to be meaningful.

Brain evolution in hominids: Are we at the end of the road? M.A. HOFMAN, Netherlands Institute for Brain Research, Amsterdam.

A progressive enlargement of the hominid brain started about 2 million years ago, probably from a gracile australopithecine form. Since then a three fold increase in endocranial volume has taken place leading to one of the most complex and efficient structures in the animated universe, the human brain. In view of the central importance placed on brain evolution in explaining the success of *Homo sapiens*, one may wonder whether there are physical limits that constrain its processing power.

Analysis of the design principles and operational modes of the neocortex in primates show that there are potential limits to the size of the brain and to the amount of information it can store and process. When the brain's geometry is considered in combination with the processing and transmission time of axons and dendrites, the degree of neuronal interconnectivity is near the capability limits of a neuron-based system. Once the brain has grown to a point where the bulk of its mass is in the form of connections, then further increases will be unproductive due to the declining capability of neuronal integration and increased conduction time. At this point, corresponding to a brain size two to three times that of modern man (i.e. at about 3,500 cm<sup>3</sup>), the brain reaches its maximal processing power. The larger the brain grows beyond this critical size, the less efficient it will become.



One cannot exclude the possibility of new structures evolving in the brain, or a higher degree of specialization of existing brain areas, but within the limits of the existing 'Bauplan' there is no incremental improvement path available to the human brain. This implies that, as a species, *Homo sapiens* is nearly at the end for brain evolution. Any further step in the evolution of intelligence will then have to take place outside our nervous system, in a silicon world where the selection mechanisms and forces are radically different from those operating in nature.

Revisiting Australopithecine visual striate cortex: newer data from chimpanzee and human brains. R.L. Holloway, D. Broadfield, and M. Yuan.

Human primary visual striate cortex (area 17 of Brodmann) is about 121% less than expected for a primate of its brain size.

The AL 162-28 brain endocast has suggested to this author that there was a relative reduction in primary visual striate cortex (area 17) and a concomitant relative increase in posterior parietal association cortex (areas 18 & 19) by 3 MYA in *A. afarensis*. Jerison offered a different explanation: that chimpanzees and hominids required similar amounts of area 17 for vision, and thus in hominids the medial neocortex would have been greater than in chimpanzees, and would have severely disrupted the medial brain profile around the calcarine fissure and splenium of the corpus callosum. Thus there could not have been a reduction in the lateral extent of primary visual cortex. He noted that fossil endocasts cannot resolve the controversy.

We believe four newer lines of evidence (non-fossil) suggest that a relative reduction in *A. afarensis* was quite feasible. (1) Modern human variation of volume of area 17 is very high with no relationship to visual deficits. Australian Aborigines have significantly more area 17 than other populations. (2) There is a significant relationship between depth of calcarine fissure and volume of area 17, which varies greatly in humans, with no or little lateral representation on the occipital lobe. (3) Additional chimpanzee brain casts show variation of the sulcal landmarks not seen before, i.e., interparietal (IP) and lunale sulcus (LS). These three observations indicate that there is considerable genetic variation behind the formation of this cortex. (4) An expanded chimpanzee sample indicates a ratio of roughly double that found in the *A. afarensis* AL 162-28 endocast for the occipital pole to inferior IP, while their brain sizes are smaller than the AL 162-28 endocast. It is also possible that compared to chimpanzees, *A. afarensis* could have had more fissuration on the lateral surface of the occipital lobe which could have prevented disruption of the medial profile.

Thus reorganization of the brain could have occurred in *A. afarensis* prior to any significant increase in brain size.

Parent-infant co-sleeping: Attitudes and practices in North Tees, England. E. HOOKER, H.L. BALL, Department of Anthropology and UCS, University of Durham, Durham DH1 3HN, UK. P.J. KELLY, Centre for Health and Medical Research, University of Teesside, Middlesbrough, UK.

This paper describes an investigation of night-time parenting strategies for a sample of parents from the North Tees region in the northeast of England. Given current debate regarding whether sleeping with parents is harmful or beneficial for an infant our aim was to explore parents' attitudes towards sleeping arrangements for their infants, and to document normal night-time parenting behavior. This prospective study examined opinion to and practice of co-sleeping in North Tees via general interviews with the parents of 60 infants, prior to the infant's birth and 3 months post-partum. By the time of the second interview 63% of the sample had co-slept with their infant(s). Parents with no previous intention to co-sleep were found to be taking their babies into bed with them for various reasons including ease of feeding, desire to monitor infant, parental need for more sleep. We found a significant relationship between breastfeeding and co-sleeping. Fifty-three percent of our sample were both breastfeeding and co-sleeping (80% of breast feeders were co-sleepers) and we identified an interesting trend towards commencement of co-sleeping after the early morning feed, usually around 2am, when infants were taken into the parental bed and remained there for the rest of the night. Perhaps the most important result was the fact that the babies were being brought into bed with both parents. Ninety-five percent of co-sleeping infants slept with both parents in bed. For only 5% of the co-sleeping infants did their fathers sleep elsewhere. This is an important finding as research into the physiological effects of co-sleeping have concentrated on infants sleeping with their mothers only.

Co-sleeping is not considered to be part of a main stream parenting ideology in the UK, and many of the parents we interviewed had received criticism from midwives, health visitors and relatives. This research indicates that despite criticism, and especially for breastfeeders, bringing their baby into bed with them is a night-time strategy which many parents find effective.

Funding received from Centre for Health & Medical Research, University of Teesside, Department of Anthropology & UCS, University of Durham, UK.

Relative fat distribution among First Nation Canadians. P.T. KATZMARZYK<sup>1</sup> and R.M. MALINA<sup>2</sup>, <sup>1</sup>Department of Kinesiology and Health Science, York University, Toronto, Ontario, <sup>2</sup>Institute for the Study of Youth Sports, Michigan State University, East Lansing, Michigan.

Differences in relative subcutaneous fat distribution between Canadians of First Nation (aboriginal) (FN) and European Ancestry (EA) were examined in 130 FN and 494 EA subjects 5-75 years of age from northern Ontario. The sample was divided into adults (20-75 years; 214 ♂, 234 ♀) and youths (5-19 years; 97 ♂, 79 ♀). Subcutaneous fatness was assessed by the sum of 6 skinfolds (SUM = abdominal + subscapular + suprailiac +

biceps + triceps + medial calf). Relative fat distribution was assessed in two ways: (1) the waist-to-hip circumference ratio (WHR), and (2) a trunk-to-extremity skinfold ratio (TER = abdominal + subscapular + suprailiac / biceps + triceps + medial calf). Differences among groups were determined using ANCOVA, with age as the covariate. Among youth, FN boys had greater subcutaneous fatness than EA boys (79.8 mm vs 57.3 mm,  $p \leq 0.006$ ), but the difference was not significant in females (80.2 mm vs 73.4 mm,  $p = 0.47$ ). Among adults, FN and EA males did not differ in subcutaneous fatness (102.1 mm vs 91.7 mm,  $p = 0.07$ ), but FN females were significantly fatter (152.5 mm vs 126.0 mm,  $p \leq 0.001$ ). Among youth, FN had significantly greater TERs in males (1.42 vs 1.08,  $p \leq 0.001$ ) and females (1.22 vs 0.98,  $p \leq 0.006$ ). Among adults, FN also had greater TERs than EA in males (2.43 vs 2.26,  $p \leq 0.05$ ) and females (1.47 vs 1.23,  $p \leq 0.001$ ). FN male youths had greater WHRs (0.90 vs 0.87,  $p \leq 0.008$ ), but FN female youth did not (0.79 vs 0.81,  $p = 0.92$ ). In adults, FN of both sexes had greater WHRs, males (0.93 vs 0.92,  $p \leq 0.008$ ), and females (0.85 vs 0.79,  $p \leq 0.001$ ). Thus, FN youth and adults have greater amounts of absolute subcutaneous fat and a more central distribution of fat than EA. Truncal fat distribution is a significant risk factor for cardiovascular disease, diabetes and other metabolic diseases, and may partially explain the high incidence of these diseases in the Canadian First Nation.

The hypoglossal canal and the origins of human vocal behavior. R.F. KAY, M. CARTMILL, and M. BALOW, Biological Anthropology & Anatomy, Duke Medical Center, Durham, NC 27710

The human hypoglossal canal transmits the nerve that supplies the muscles of the tongue. This canal is absolutely and relatively larger in modern humans than it is in the African apes (*Pan* spp. and *Gorilla*). From this difference, we infer that the human tongue is more richly supplied with motor nerves than are those of living apes. We postulate that canal size in fossil hominids may provide an indication about the motor coordination of the tongue and reflect the evolution of speech and language. Hypoglossal canals of gracile *Australopithecus*, and possibly *Homo habilis*, fall within the range of extant *Pan* and are significantly smaller than those of modern *Homo*. The hypoglossal canals of Neanderthals and an early 'modern' *Homo sapiens* (Skhul V), as well as of African and European archaic *Homo sapiens* (=H. *heidelbergensis*) (Kabwe and Swanscombe), fall within the range of extant *Homo* and are significantly larger than those of *Pan troglodytes*. These findings suggest that the vocal capabilities of *Homo*, including Neanderthals, may have been essentially modern by at least 600,000 years ago, that those of *Australopithecus* were not significantly advanced over those of chimpanzees, and that human-like speech considerably preceded the first archaeological evidence for symbolic behavior.

Research supported by Duke University Research Council.

Are we underestimating canine sexual dimorphism in humans? H.J. KEENE, Univ. of Texas HSC, Dental Branch, Houston, TX 77225.

Human canine teeth exhibit minor crown size sexual dimorphism (2-8%) compared to other primates and most studies have used mesiodistal (MD) and/or buccolingual (BL) crown diameters. In order to examine a more complete range of sexual dimorphisms, 161 maxillary (M=91; F=70) and 86 mandibular (M=45; F=41) canine teeth were evaluated for sexual dimorphism in 7 different crown and/or root size attributes. Teeth were weighed to nearest 0.01 gm and, for maxillary teeth only, 6 dimensions were obtained with a caliper: MD and BL crown diameter, tooth height (TH), crown height (CH), root height (RH) and buccolingual root width at the cervix (RW). Measurement error was assessed from double determinations. Means and standard deviations (S.D.) were calculated, and sexual dimorphisms were expressed as a percent (M-F/F) X 100. Significance of M/F differences was evaluated by unpaired t-test.

The greatest dimorphism was observed for tooth weight (maxillary canine=26.5%; mandibular canine=20.2%). Caliper measurements of the maxillary canine indicated a gradient of dimorphisms ranging from 3.0% for MD crown diameter to 11.4% for root height (RH). Other values were intermediate: BL crown diameter=7.6%; tooth height=9.7%; crown height=10.0%; buccolingual root width=10.0%. Mean male values for all 8 measurements obtained in the study were significantly larger ( $p < 0.001$ ) than female values.

Although MD and BL crown diameter dimorphisms are consistent with previous studies (reviewed by Keene, 1991), data on other measurements are too sparse for meaningful comparisons. Colby (1996 AAPA abstr) noted sexual dimorphisms ranging from 5.7% to 8.5% for cervical BL and MD diameters in 2 Western Gulf of Mexico precontact populations. Our tooth weight data appear to be unique thus far and are noteworthy in that the weight dimorphisms are in the same ballpark as those observed for human adult body weight (26.4% ; Krogman, 1972). Additional studies on other populations are indicated.

Non-competitive replacement of apes by monkeys in the late Miocene of Eurasia. J. KELLEY, University of Illinois at Chicago, Chicago, IL 60612

Among the modern Old World primate fauna, the diversity of monkeys greatly exceeds that of apes. The

situation appears to have been the reverse during the early Miocene. Several explanations have been proposed for what is purported to be the progressive replacement of apes by monkeys over the course of the Miocene. Common to all of these explanations is that the replacement of apes by monkeys was either directly or indirectly competitive in nature; that is, that it was in fact displacement. However, the coexistence of monkeys and apes, both at present and at certain localities in Africa during the Miocene, suggests that changes in the relative diversities of the two groups since the early Miocene might not have resulted from competitive interactions.

To further explore this question, I examined the three well-documented late Miocene stratigraphic sections that contain both apes and monkeys. These are the Siwalik sequence in northern Pakistan, the Lower Axios Valley sequence in northern Greece, and the Baccinello sequence in northern Italy. These sections were found to share two important characteristics with respect to their primate faunas: First, in each there is a temporal hiatus between the local extinction of apes and the first appearance of monkeys. Second, the period of this hiatus was a time of substantial turnover in the mammalian faunas as a whole. For two of the examined sections, the ecological character of the faunal turnover has been investigated through the use of stable carbon isotopes from paleosol carbonates. These reveal that in the Siwaliks and the Lower Axios Valley, faunal change was accompanied by shifts from C<sub>3</sub> trees and shrubs to a greater abundance of C<sub>4</sub> grasses, resulting in more open habitats. Taken together, these and other lines of evidence suggest that, in Eurasia at least, the replacement of apes by monkeys was non-competitive in nature and was a part of more general faunal change in response to changing habitats.

**Morphometric variability in *Homo erectus*.**  
J.H. KIDDER, University of Tennessee.  
Knoxville TN 37996-0720, USA.

It has recently been suggested that *Homo erectus* specimens in Africa and East Asia possess discrete trait differences indicating separate species designations (Andrews and Franzen 1984; Stringer 1984; Wood 1984). Critics of this view maintain that the traits in question have a continuous distribution not reflective of different species (Bräuer 1994; Bräuer and Mbua 1992; Rightmire 1986, 1987, 1990). Few multivariate analyses have been performed using the metric data to answer this question, however (most notably Bräuer 1994), and none have systematically accounted for size and shape.

Using 18 *Homo erectus* crania, multivariate analyses are performed on principal components of shape (after Darroch and Mosimann 1985) to determine the degree of separation

between the geographical samples. To control for diachronic trends, the East Asian crania are separated into early and late samples.

These analyses show that the Chinese sample is clearly removed from the other geographical samples for all analyses performed. Furthermore, statistically significant differences are found between all three Chinese hominids used and most SE Asian hominids. These results suggest that, while there is not a clear separation between African and early or late SE Asian *Homo erectus*, the Chinese *Homo erectus* sample is morphometrically dissimilar.

Metric analysis of sexual dimorphism in the Thai tibia. C.A. KING, Department of Anthropology, University of Hawaii Honolulu, HI 96822, M.Y. IŞCAN, 727 NW 7th Drive, Boca Raton, FL 33486, and S.R. LOTH, Department of Anatomy, University of Pretoria, Pretoria 0001, South Africa.

Many studies have clearly demonstrated that metric analysis of sex differences is highly population specific, even in different parts of the same geographic region. In the past, Asian studies have focused on East Asia - primarily on China and Japan. Few studies have been attempted on Southeast Asian inhabitants and at present, there is a need for metric standards for sex determination in Thais. Preliminary research has revealed that many osteometric dimensions of Thais are smaller than other Asians. Therefore, the purpose of this study is to establish discriminant function formulae for sex determination from the Thai tibia.

The sample (N=103) consists of documented individuals from Chiang Mai University Hospital, Thailand. A total of seven standard measurements were taken and subjected to SPSS discriminant function analysis. The stepwise procedure was then used to choose the optimal combination of dimensions, and the direct method was used to analyze measurements, individually, and in combination for application to a fragmented bone. Four dimensions were selected by the stepwise function in the following order: proximal epiphyseal breadth, circumference (at nutrient foramen), distal epiphyseal breadth, and transverse shaft diameter (at nutrient foramen). This function produced an average accuracy of 94%. When individual dimensions were analyzed, classification accuracy ranged from 84% (circumference) to 88% (proximal breadth) to 89% (distal breadth).

Sexing accuracy of 94% from the tibia attained by the stepwise generated function for this sample exceeds that reported for American whites (86%), American blacks (90%), and Japanese (87%). This study of Thais agrees with earlier work on diverse populations that the most discriminating sex indicators in long bones tend to be proximal and distal dimensions.

In conclusion, this work reveals that intra and interracial variation in sexual dimorphism is clear both in its degree of expression and its distribution within a single bone. The present study leaves no doubt that the metric manifestations of sexual dimorphism are highly population specific and it is therefore imperative to calculate appropriate standards for even relatively closely situated populations. However, it is also important to note that there are certain human commonalities, such as the apparent discriminatory consistency of proximal and distal dimensions in the tibia and findings that the extent of sexual dimorphism in this bone is contained within a 10% range in most populations.

C.A.K. is grateful to Dr. Tejjat at Chiang Mai University hospital for access to their skeletal collections.